

FABRIC WITH MAGNETIC FIBERS

CROSS-REFERENCE TO RELATED APPLICATIONS

Not Applicable.

5 STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable.

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

10 This invention relates generally to a fabric and, more particularly, to a magnetic fabric formed with individual magnetic fibers.

2. DESCRIPTION OF RELATED ART

15 According to the inventions described in U.S. Patent Nos. 237,939, 3,921,620, 4,162,672 and 6,093,143, it is well known to attach discrete magnets to fabrics that are worn by a person as apparel or draped over the person for therapeutic purposes. Such magnets are not integral with the fibers that are woven into the fabric or with the fabric sheet. Instead, the fibers are manufactured in a process distinctly separate from the manufacture of the magnets, and the magnets must therefore be separately attached to the fabric at particular locations. The magnets may be small enough to be embedded into a sheet of synthetic material, but such embedding magnets are not applied to the
20 individual fibers and instead applied after weaving the fibers into the fabric.

Similarly, according to the respective inventions described in U.S. Patent Nos. 4,549,532 and 5,882,292, it is also known to embed magnetic material into a sheet and to layer a magnetic material onto a fabric. The magnetic layer may be integral to such a layered magnetic fabric and the

sheet, but the layer is not integral to individual fibers that form the fabric. To form the magnetic fabric, first the non-magnetic fabric must be formed using traditional weaving processes, and then the magnetic layer can be applied thereto.

Finally, according to the invention described in U.S. Patent No. 4,515,850, it is known to surround a core fiber with a sheath of magnetic material and that such core-sheath fibers can be woven into a ferrite cloth for electronic equipment. Even though the electronic equipment may include electromagnetic shields and permanent magnets, the purpose of such ferrite cloths is for the manufacture of electronic equipment and such ferrite cloths are not intended to be worn by or cover a person. A core-sheath fiber with a composite ferrite cover may be acceptable for electronic equipment, but it would not provide the look and feel that a person would expect from traditional textile fabrics. Additionally, multiple ferrite cloths must be laminated together for practical use in electronic equipment, whereas no such lamination is generally required for fabrics that are worn by or otherwise cover a person.

BRIEF SUMMARY OF THE INVENTION

It is in view of the above problems that the present invention was developed. The invention is an article of magnetic fabric formed from individual magnetic fibers and preferably held in a desired shape with stitches. The magnetic fibers are preferably sheath-core fibers with a magnetic core and a traditional textile sheath. In an alternative embodiment, the magnetic fibers are a composite of magnetic particles encapsulated in a polymer. The fabric can be formed using traditional construction methods, including weaving, knitting, and nonwoven processes. The magnetic fabric has an aesthetically pleasing drape and a tactile handle. The magnetic fibers can be made using a slit film process suitable for textiles, and the magnetic fibers can be woven in

patterns. Additional layers of magnetic material can be formed on or incorporated into the magnetic fabric using known processes for textiles, including finishing, coating, and printing processes, and solid magnets can also be added to the magnetic fabric using known techniques.

Accordingly, it is one advantage of the present invention to provide magnetic fibers that can be woven into a fabric. It is another advantage of the present invention to provide a magnetic core-weave fabric that has therapeutic efficacy and also has a look and feel that is substantially similar to traditional textile fabrics. It is yet another advantage of the present invention to provide a magnetic fabric that can be further processed to incorporate additional magnetic properties into the magnetic fabric. It is yet another advantage of the present invention to provide a method for using a plurality of magnetic fibers for therapeutic purposes.

Further features and advantages of the present invention, as well as the structure and operation of various embodiments of the present invention, are described in detail below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and form a part of the specification, illustrate the embodiments of the present invention and together with the description, serve to explain the principles of the invention. In the drawings:

Figure 1 illustrates a magnified, perspective view of an article of magnetic fabric according to the present invention;

Figure 2 illustrates a cross-sectional view of a magnetic sheath-core fiber preferably used in the present invention;

Figure 3 illustrates a cross-sectional view of an alternative embodiment of a composite

magnetic fiber used in the present invention; and

Figure 4 illustrates several optional design features according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

5 Referring to the accompanying drawings in which like reference numbers indicate like elements, Figure 1 illustrates a detailed view of a magnetic article **10** that is formed from a magnetic fabric **12** and preferably has a plurality of stitches **14** for holding the fabric **12** in its desired shape. In the preferred embodiment, the magnetic fabric **12** is woven from a plurality of individual magnetic fibers **16**. The magnetic article **10** can also be formed from a magnetic fabric **12** that is constructed using other traditional techniques for fabrics, such as knitting and nonwoven processes.

The magnetic article **10** can be used to cover or otherwise adorn a user thereof. For example, a magnetic article **10** could include clothing, fabric-type jewelry, towels and linens, and therapeutic devices. Each of these magnetic articles **10** can be made from the magnetic fabric **12** and has a similar function in that it remains in close proximity to the user during its usage. Although the preferred user would be a person, it is conceivable that magnetic article **10** could be used for pets, livestock, and other animals and beasts of burden, and it is within the realm of possibility that such a magnetic article **10** could be designed according to the present invention for certain plants. Therefore, the application of the magnetic article **10** may influence the design or the
20 desired shape of the magnetic fabric **12**.

The magnetic fibers **16** can be formed from a slit film process that is suitable for textile processing. Fibers formed from a slit film process, slit film fibers, are typically flat and are traditionally produced by slitting an extruded polymeric film. The polymeric film is extruded and

then slit into multiple strands before being drawn into the fibers. The slit film fibers may also undergo an additional heating and drawing process to produce fibrils in the fiber's longitudinal direction, giving the fibers a lattice-work appearance.

As respectively illustrated in Figures 2 and 3, the magnetic fibers 16 can be a sheath core fiber 18 or another form of magnetic composite fiber 20. The sheath-core fiber 18 has a magnetic core 22 that is surrounded by a textile sheath 24. The magnetic core 22 and the magnetic composite fiber 20 can be formed by encapsulating magnetic particles 26 within a polymer fiber matrix 28. Alternatively, the magnetic core 22 and the composite magnetic fiber 20 may be formed using known textile processing methods, such as coating the surfaces 30, 32 of the magnetic core 22 and the fiber matrix 28 with magnetic particles 26 or printing magnetic particles 26 thereon or otherwise adhering magnetic particles 26 thereto. The magnetic particles 26 may also be embedded into the surfaces 30, 32, or the magnetic core 22 and the fiber matrix 28 can be finished or otherwise formed with magnetic particles 26. For the core-sheath fiber 18, the magnetic core 22 may also be a thin magnetic wire.

The magnetic fabric 12 is woven from fibers that use traditional textile materials in combination with magnetic particles 26 to give the magnetic fabric 12 an aesthetically pleasing drape and a tactile handle. Accordingly, each of the magnetic fibers 16 can be individually formed using polymers or natural fibers in combination with magnetic particles 26. Polymeric fibers can be made using regenerated cellulose and synthetic polymers, such as polyester, polyamide and other man-made polymers. Natural fibers may include silk, wool, mohair, cotton, hemp, flax, jute, and ramie. For the core-sheath fiber 18, the textile sheath 24 may include magnetic particles 26 or may be free from any magnetic particles 26. Therefore, the look and feel of the magnetic fabric 12 can be made substantially similar to the look and feel of traditional non-magnetic fabric articles, and the

magnetic fabric 12 does not substantially limit the desired shape of the magnetic article 10.

As one example of the present invention for magnetic article 10, Figure 4 illustrates several optional design features that can be used for clothing, fabric-type jewelry, towels and linens, and therapeutic devices. The magnetic fibers 16 can be woven into the magnetic fabric 12 in a pattern

5 34. After the fibers 16 are woven into the magnetic fabric 12, a layer of magnetic material 36 can be formed on or integrally with the magnetic fabric 12 and any number of solid magnets 38 can be attached to the magnetic fabric 12. The solid magnets 38 can be attached to the magnetic fabric 12 alternatively to the layer 36 or in combination therewith. To attach another magnetic fabric layer 40 to the magnetic fabric 12, a plurality of stitches 42 can be used. The aesthetically pleasing drape and tactile handle are still maintained when multiple layers of magnetic fabric 12, 40 are used because the layers of magnetic fabric 12, 40 are not laminated together for the magnetic article 10. The magnetic fabric layer 40 may also cover other optional design features, such as the layer of magnetic material 36 and/or the solid magnet 38. In the particular example, the magnetic article 10 is covering a person 44.

It will be appreciated that the entire magnetic article 10 can be formed from magnetic fabric 12 that is free of these optional design features. In such a case, the magnetic article 10 can be made with a substantially uniform magnetic field distribution. The magnetic field distribution can be modified by using magnetic fibers 16 with varying levels of magnetism to form different patterns 34 in the magnetic fabric 12. Additionally, the optional design features can be used to concentrate

20 the magnetic field at particular locations, and the overall design can be incorporated into the desired shape of the magnetic article 10. Concentrating the magnetic field is particularly beneficial for making a magnetic article 10 for therapeutic purposes. Accordingly, depending on its preferred design, the magnetic article 10 can have an even distribution of magnetic fields over its entire

surface and can have regions of varying magnetic field strength, including some regions with very little or no magnetic properties 46.

Accordingly, based on the description above and the related drawings, the present invention includes a method for using the magnetic fibers 16 to make a magnetic article 10 for therapeutic
5 purposes. The magnetic fibers 16 are woven into the magnetic fabric 12. The magnetic fabric 12 is preferably sewn to hold the desired shape for the magnetic article 10 that is held in close proximity to the body of a user 44. Before weaving the fabric 12, the individual magnetic fibers 16 can be formed using any of the methods set forth above. It will be appreciated that the magnetic fabric 12 can also be formed by knitting and nonwoven processes.

The magnetic fibers 16 can be woven in a pattern 34, and the fabric 12 can be cut into multiple shapes that form portions of the desired shape for the magnetic article 10. For example, clothing and other apparel designs usually have a desired shape that is formed by sewing together several sections such that there are stitches 14 between the various sections, such as sewing a shirt together (not shown) with sleeves, a body, and a collar. Similarly, for a therapeutic device, such as a back brace (not shown), suspenders may also be sewn to the back brace and the raw edges of the back brace fabric may be sewn into a hem. For bed linens, it is also common practice to sew a hem into the edges of the fabric. For each of these applications for the magnetic fabric 12, the magnetic article 10 is maintained in close proximity to a body of a user to improve the therapeutic efficacy. Accordingly, the user may wear or even lie on or under the magnetic article 10.

20 After weaving the magnetic fabric 12, standard textile processing can be used to coat the magnetic fabric 12 with the layer of magnetic material 36 or to print the layer of magnetic material 36 onto the magnetic fabric 12 or otherwise adhering magnetic particles 26 thereto. The magnetic fabric 12 can also undergo a finishing process in which the layer of magnetic material 36 may be

integrally formed therewith. The solid magnet **38** can also be attached to the magnetic fabric **12**. Additionally, the magnetic fabric layer **40** can be sewn to the magnetic fabric **12**, and magnetic particles **26** may be embedded into the magnetic fabric **12**.

In view of the foregoing, it will be seen that the several advantages of the invention are achieved and attained. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated.

As various modifications could be made in the constructions and methods herein described and illustrated without departing from the scope of the invention, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative rather than limiting. For example, the magnetic fibers **16** can be woven into patterns **34** that have shapes other than those particularly illustrated, and these shapes may be significantly different for according to the type of magnetic article **10**, including its preferred design and desired shape. Thus, the breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims appended hereto and their equivalents.